LIS / OTD Gridded Products

V 2.2 : 1995 - 2005
Documentation and Examples

1 September 2006

Gridded vs Orbit products

- For most climatological or time series studies, the gridded products are preferable to the individual orbit HDF's
- They apply the MSFC best-estimate of spatially and diurnally varying detection efficiency, and correct for instrument viewing time.
- OTD and LIS datasets have been intercalibrated and merged for the products. Nonetheless, care should be used in interpreting time series results between the OTD-only window (5/95-11/97), the overlap window (12/97-4/00) and the LIS-only window (12/97-present).
- Orbit HDF's should be used if individual flash times, locations, properties, etc are needed (e.g., for cross-sensor comparisons)

Naming Convention

- **HR = High Resolution (0.5 degree grid)**
- **LR = Low Resolution (2.5 degree grid)**
- FC = Annualized Climatology (full year)
- SC = Seasonal Climatology (3-monthly)
- MC = Monthly Climatology
- AC = Annual Climatology (daily)
- DC = Diurnal Climatology (hourly)
- TS = Time Series (daily or monthly)

Master HDF Dataset List

	Annualized	Time Series	Seasonal	Monthly	Daily	Hourly
HRFC	•					
LRFC	•					
HRMC	•		•	•		
HRAC	•				•	
LRAC	•				•	
LRADC	•				•	•
LRDC	•					•
LRMTS		•		•		
LRTS		•			•	
LRACTS	•				•	

Smoothing

- **Note:** The nominal grid resolution may be higher than the resolution of the data going into it. Significant spatial and temporal smoothing may have been used to generate meaningful estimates. This is documented for each individual file.

- E.g., the HRAC (High Resolution Annual Climatology) contains data at daily resolution (365 grids), but each grid represents a +/- 55-day moving average.

Dates of Data

- **OTD:** May 1995 - April 2000
  - Global coverage
  - ~ 60% uptime; 110-day diurnal alias window
- **LIS:** Jan 1998 - Dec 2005
  - Tropical (~35N/S) coverage. Slightly more after TRMM orbit boost.
  - ~ 99% uptime; 98-day diurnal alias window
  - Climatology grids are full years; time series may not be aligned with year boundaries

File Type / Contents

- Files are HDF Version 4
- Simple SDS (Scientific Data Set) Grids, 2-or-more dimensional
- Accessible with NCSA HDF tools, many 3rd-party applications, or the included IDL “getgrid.pro” procedure
- Units are embedded with grid dimensions

Key grid within each file

- **XXXX_COM_FR**
  - **COM**bined **F**lash **R**ate density (flashes / area / time)
  - Merged estimate from OTD and/or LIS
  - Scaled by best estimate of diurnally-varying detection efficiency (DE)
  - DE-Scaled Flashes divided by Viewtime

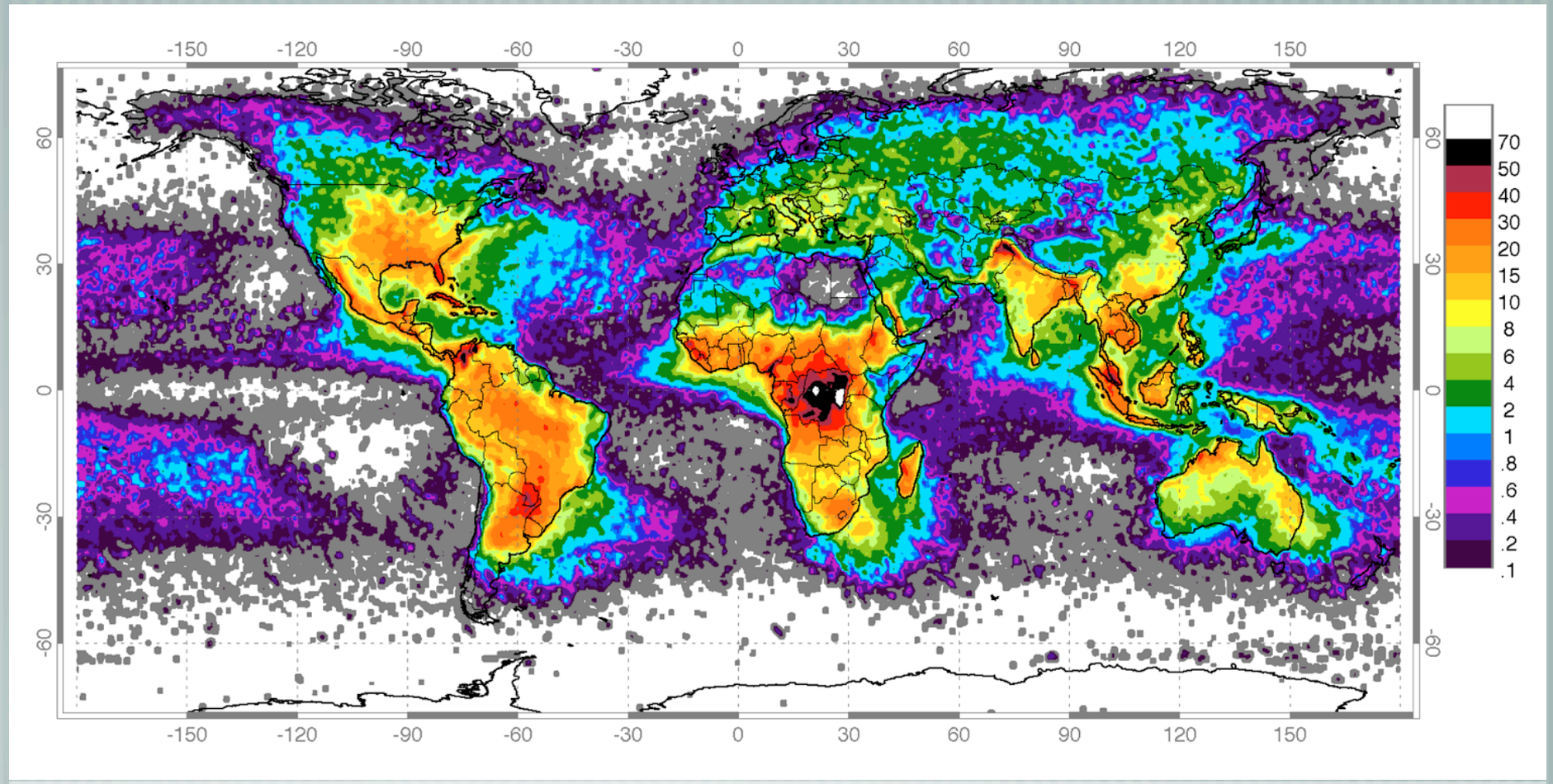
Diagnostic grids within some files

- **XXXX_OTD_FR, XXXX_LIS_FR**
  - Uncombined **OTD** and **LIS** Flash Rate Densities
- **XXXX_XXX_VT**
  - Total **V**iew**T**ime used to compute FR
- **XXXX_XXX_RF, XXXX_XXX_SF**
  - Total **R**aw, DE-**S**caled **F**lash counts used to compute FR

HRFC (High Resolution Full Climatology)

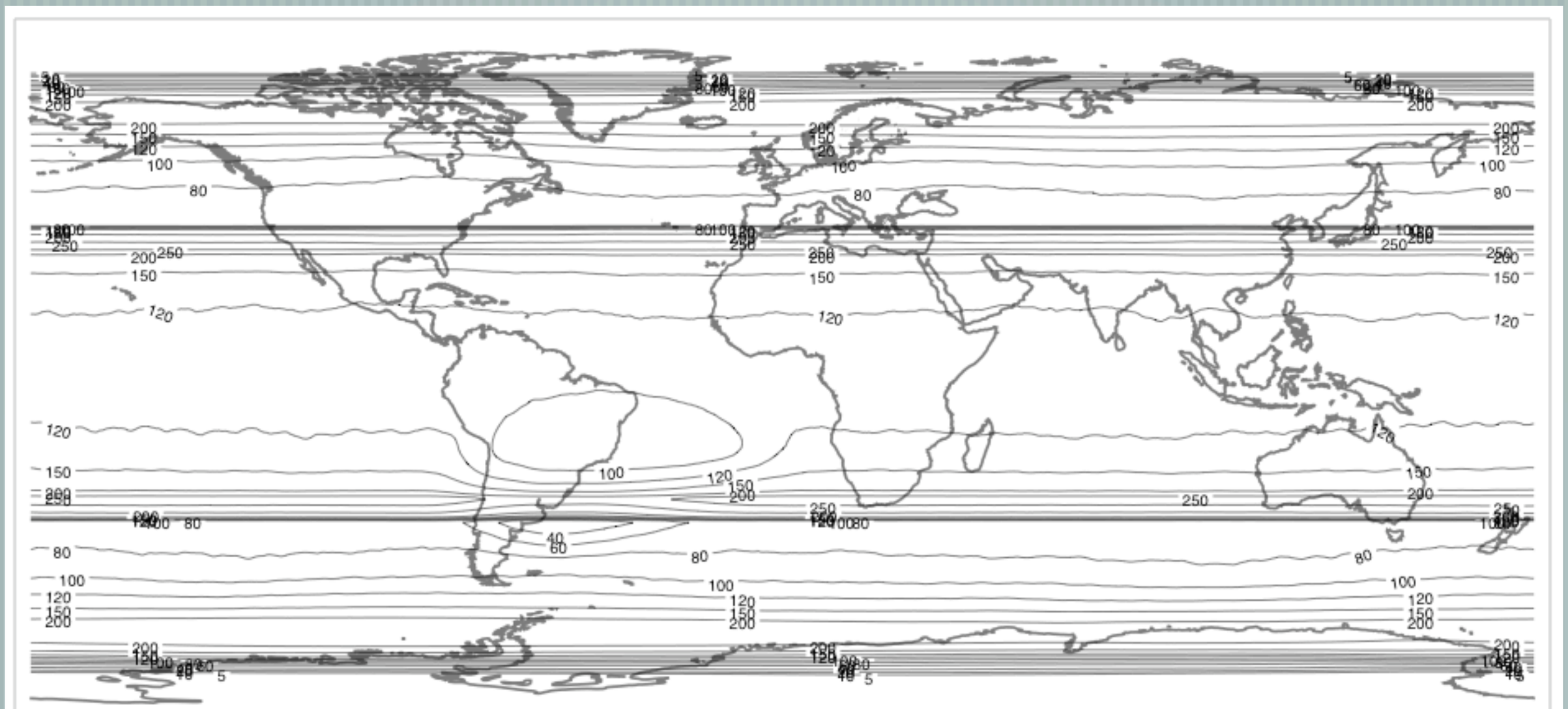
- SDS: HRFC_COM_FR:
  - 0.5 deg resolution, 720x360; flashes / km^2 / year

*Also:
HRFC_OTD_FR,
HRFC_LIS_FR,
HRFC_OTD_SF,
HRFC_OTD_RF,
HRFC_OTD_VT,
HRFC_LIS_SF,
HRFC_LIS_RF,
HRFC_LIS_VT



HRFC (High Resolution Full Climatology)

Total viewing time for HRFC_COM_VT (hours):



LRFC (Low Resolution Full Climatology)

SDS: LRFC_COM_FR:

- 2.5 deg resolution, 144x72; flashes / km^2 / year

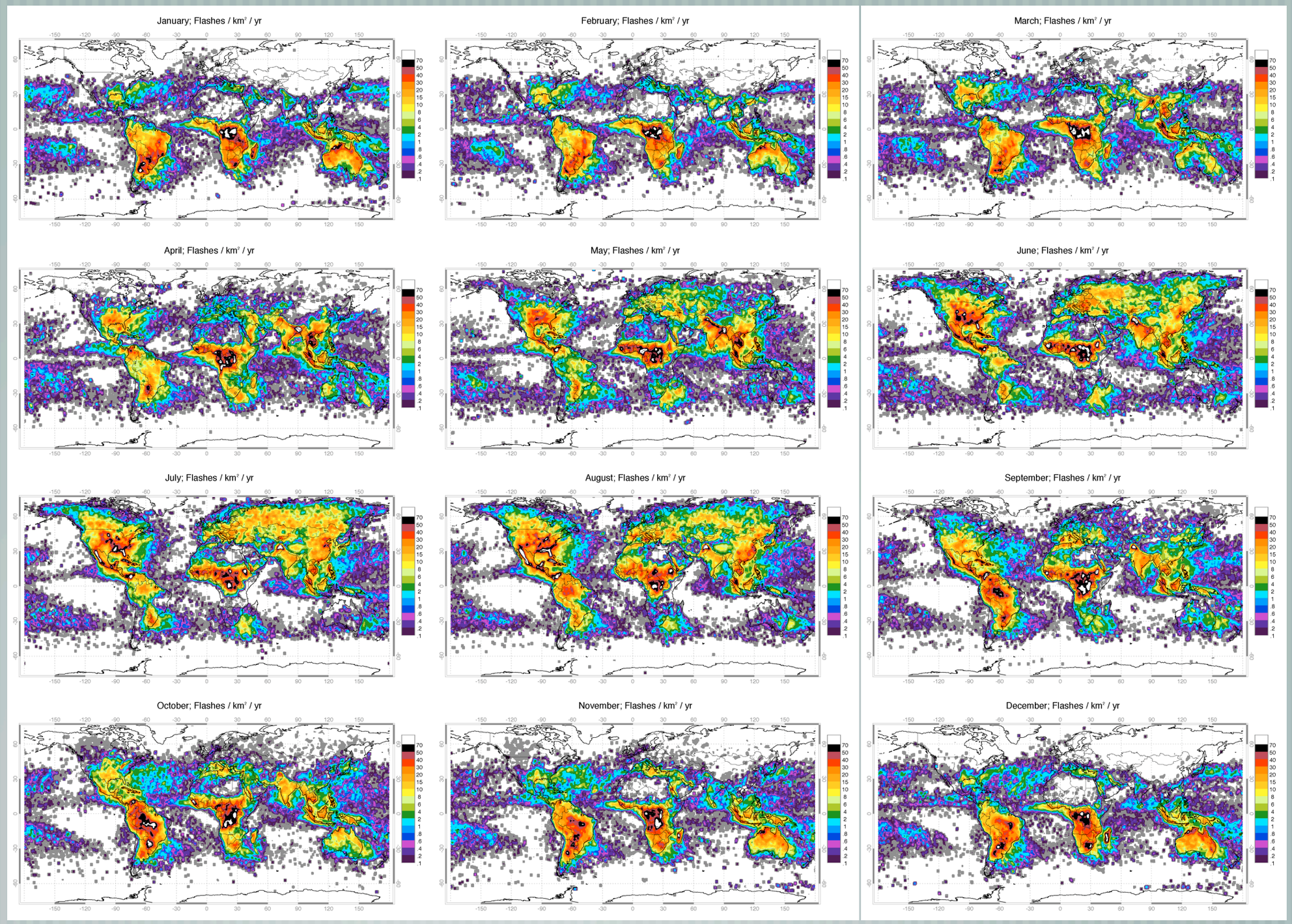
*Also:
LRFC_OTD_FR, LRFC_LIS_FR, LRFC_OTD_SF, LRFC_OTD_RF, LRFC_OTD_VT,
LRFC_LIS_SF, LRFC_LIS_RF, LRFC_LIS_VT

HRMC (High Resolution Monthly Climatology)

- SDS: HRMC_COM_FR (monthly):
  - 0.5 deg resolution, 12x720x360; flashes / km^2 / day
  - 30-day average centered on 15th of each month
  - 2.5 deg moving average applied to each 0.5 deg grid
- SDS: HRSC_COM_FR (seasonal):
  - As above, but:
  - 90-day average centered on 15th of each month

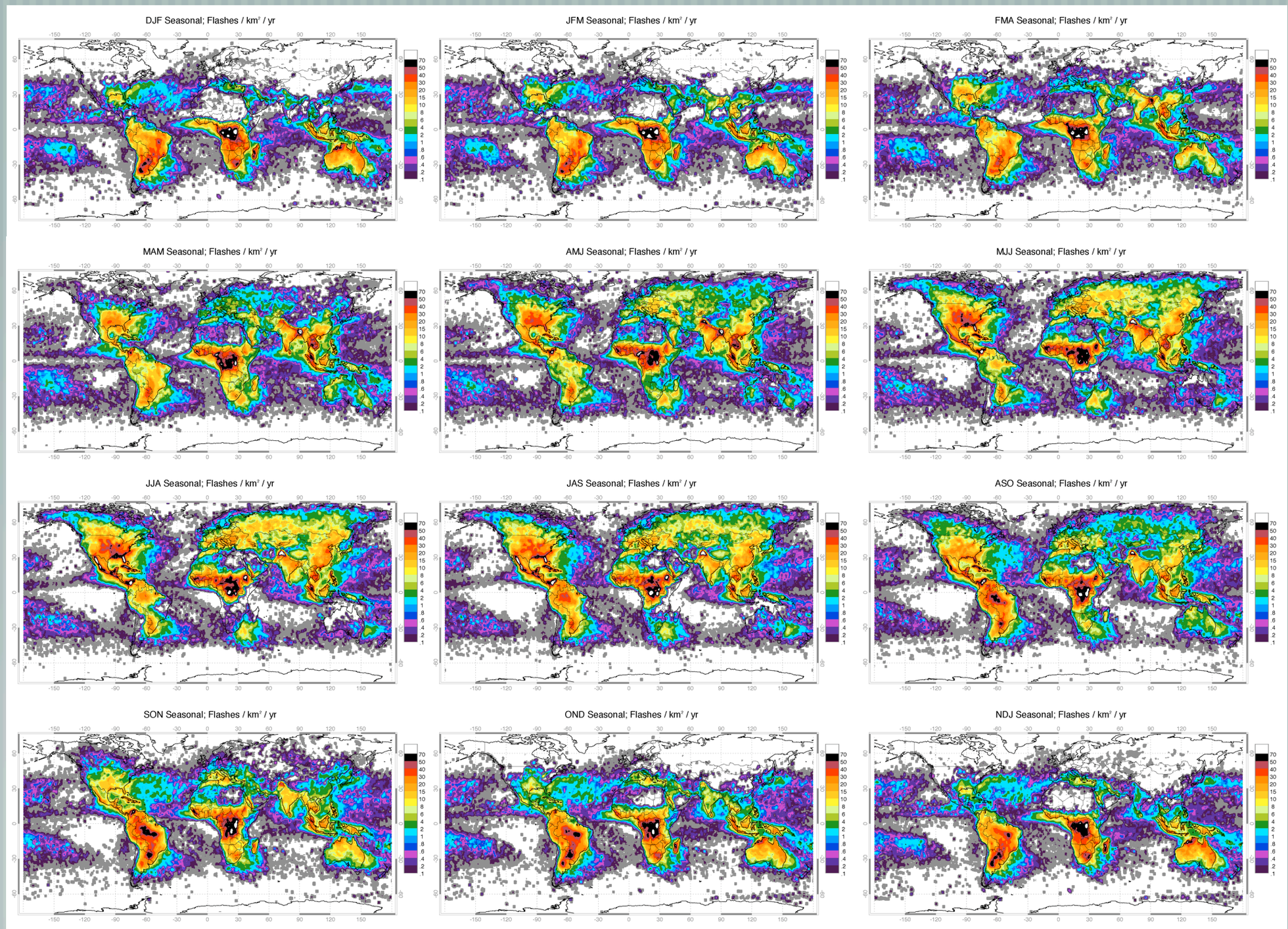
HRMC (High Res Monthly Climatology Grids)

HRMC



HRMC (High Res Seasonal Climatology Grids)

HRSC

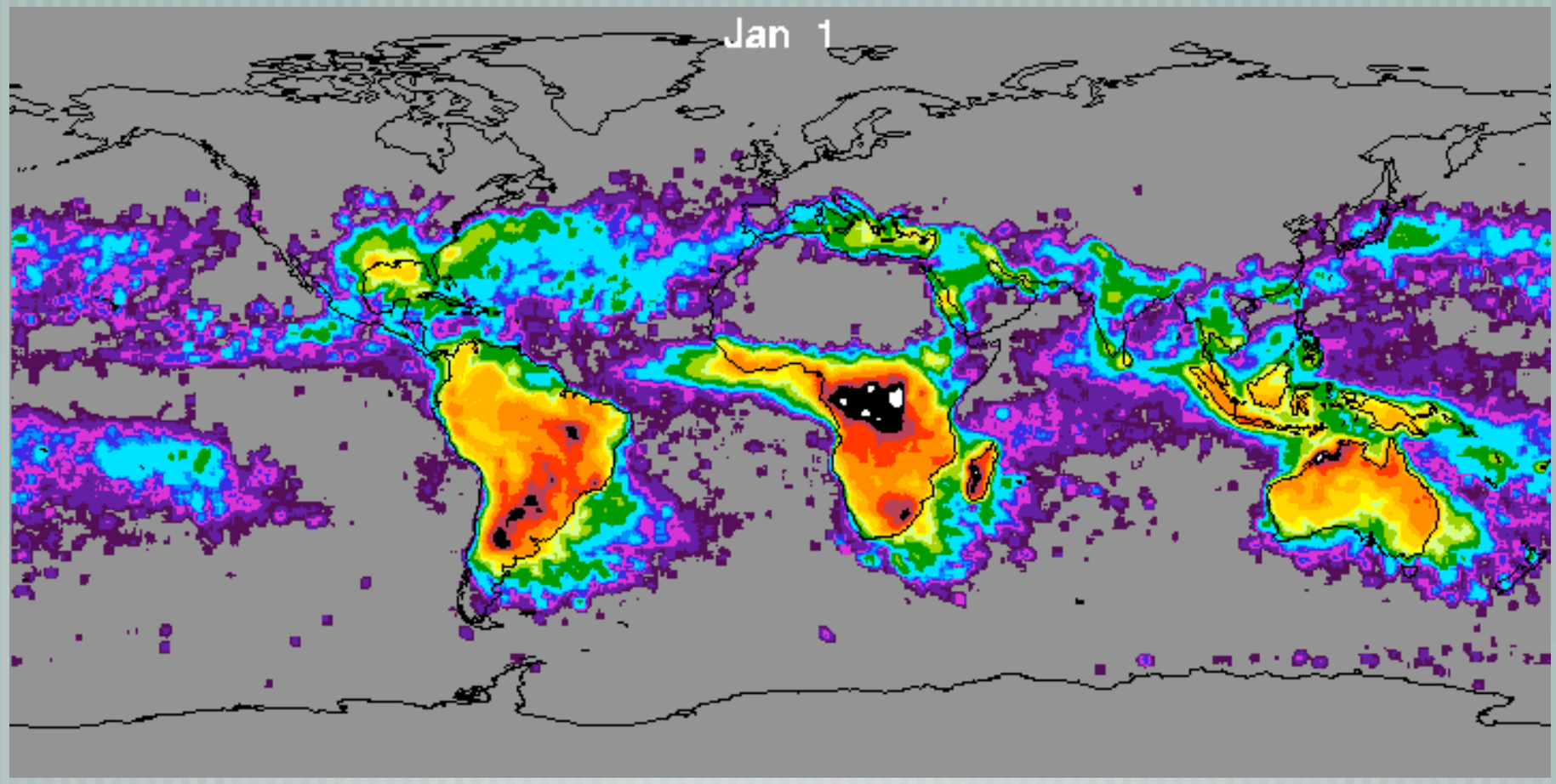


HRAC (High Resolution Annual Climatology)

- SDS: HRAC_COM_FR (daily):
  - 0.5 deg resolution, 365x720x360; flashes / km^2 / day
  - 110-day moving average centered on each day of year
  - 2.5-deg moving average applied to each 0.5 deg grid
  - Minimal diurnal aliasing, smooth annual cycle evolution

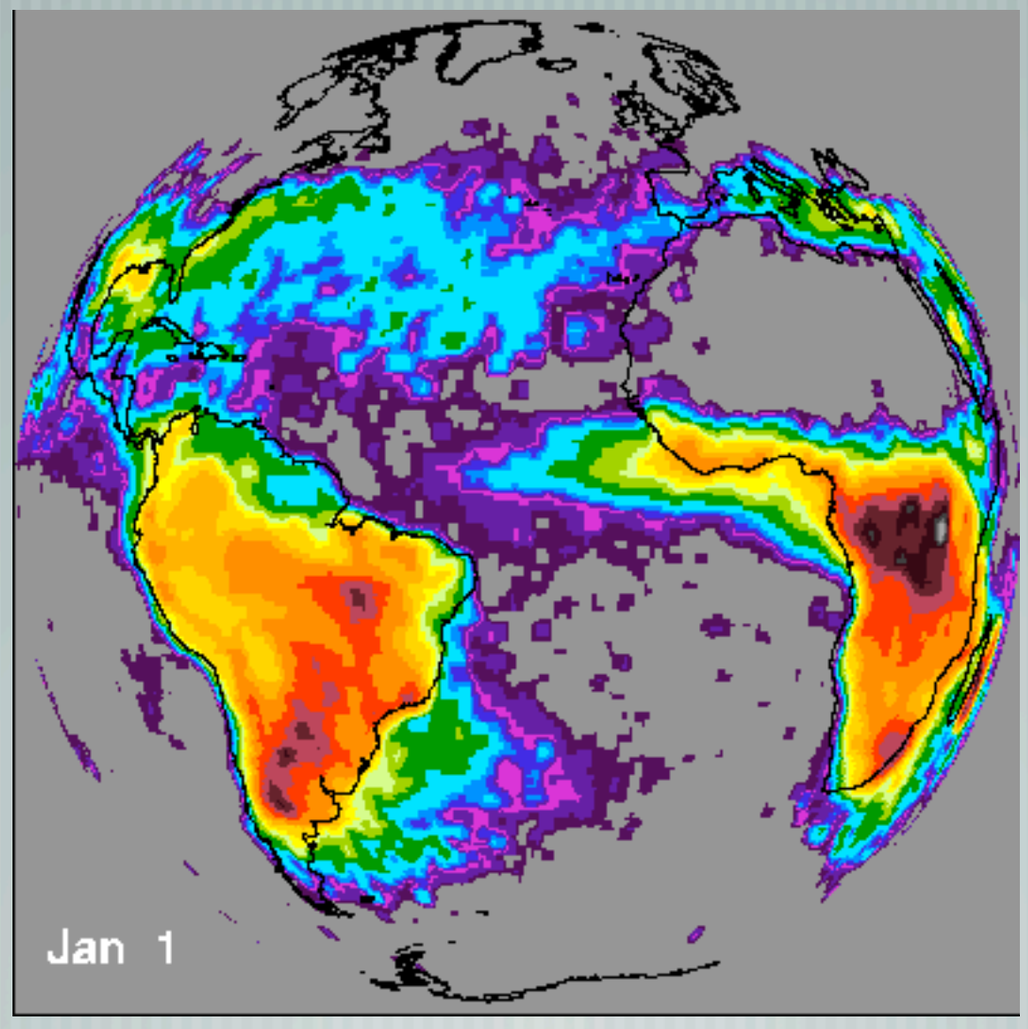
HRAC (High Resolution Annual Climatology)

Sample animation:

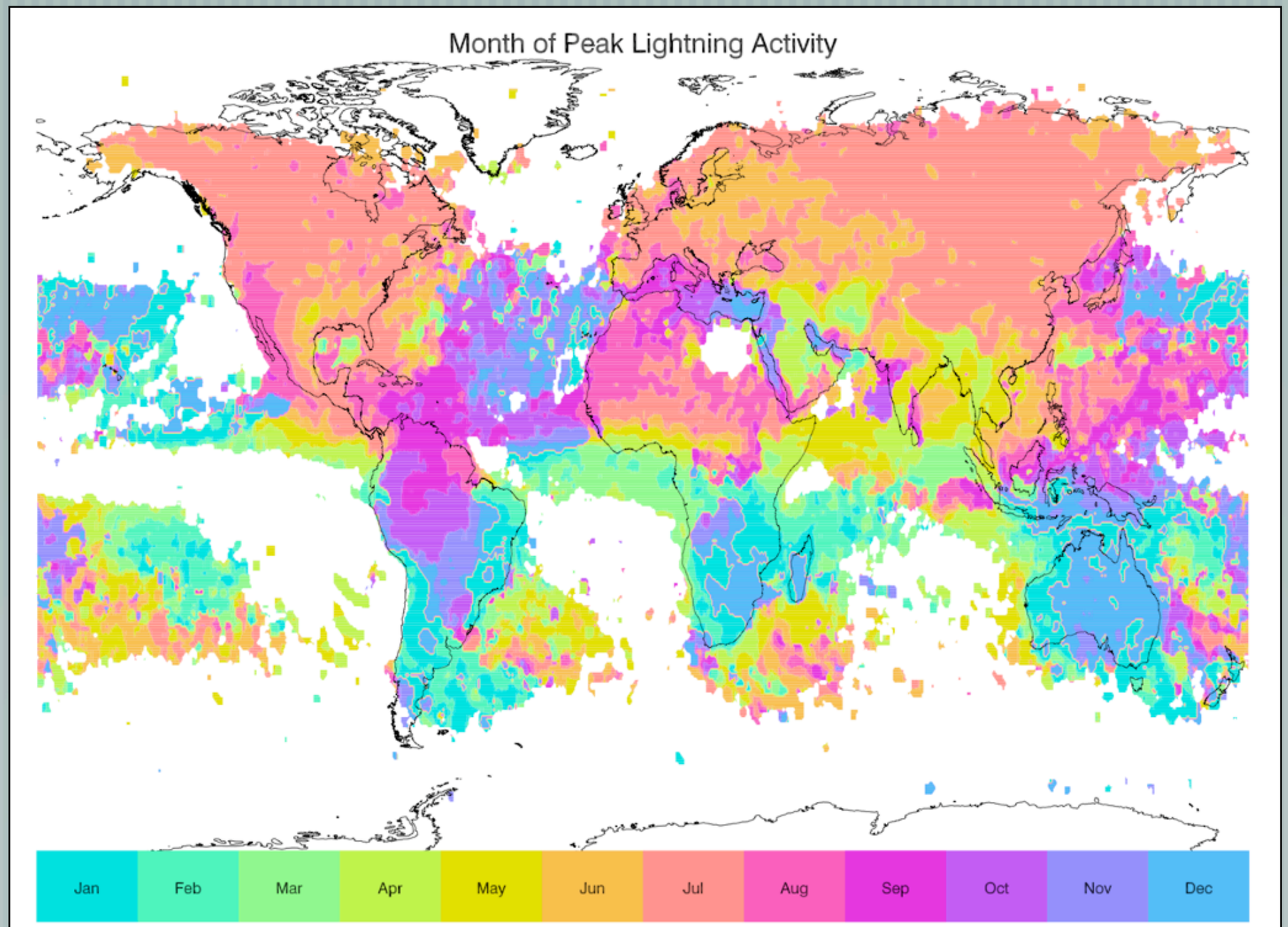


HRAC (High Resolution Annual Climatology)

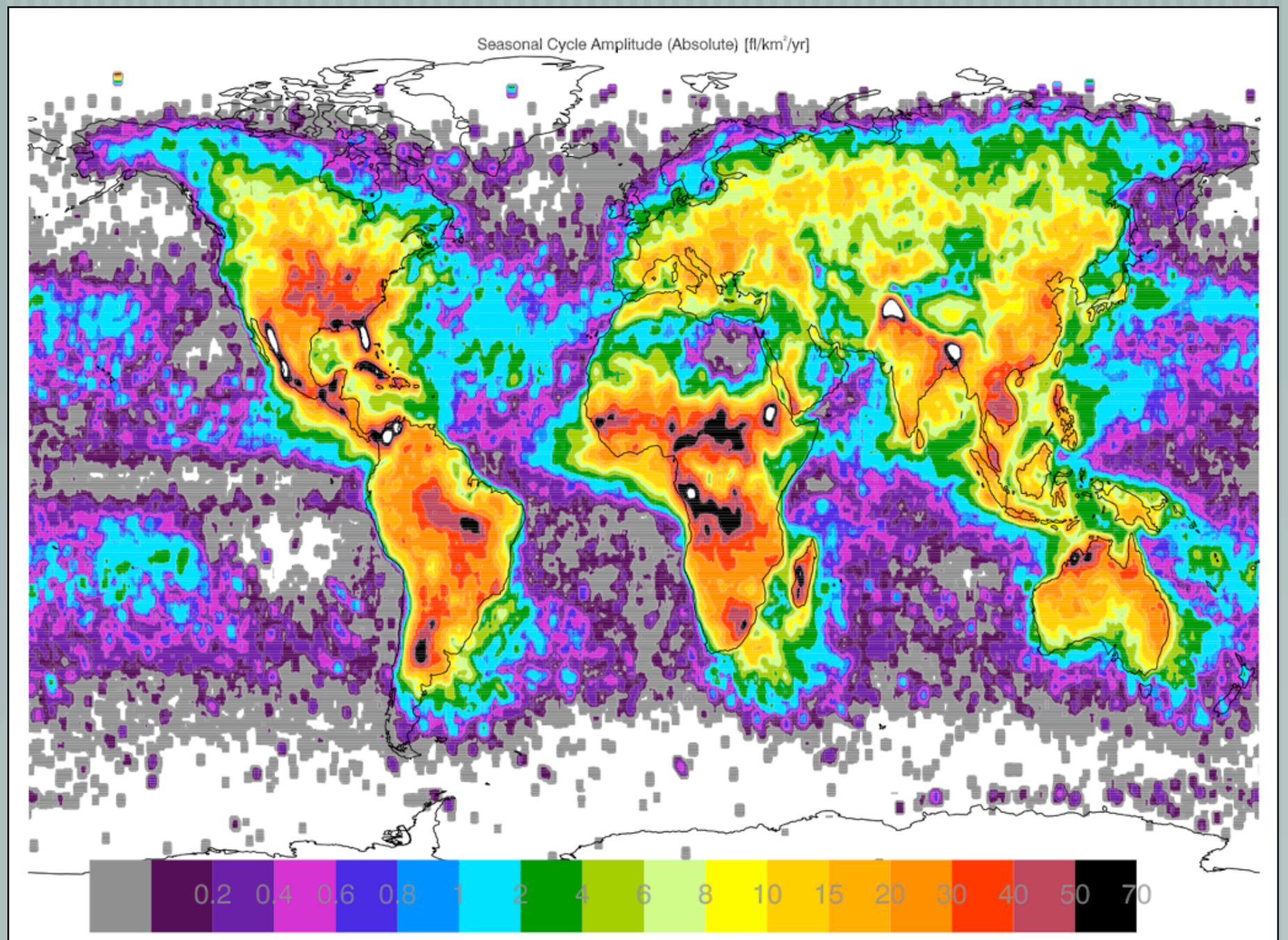
Sample animation



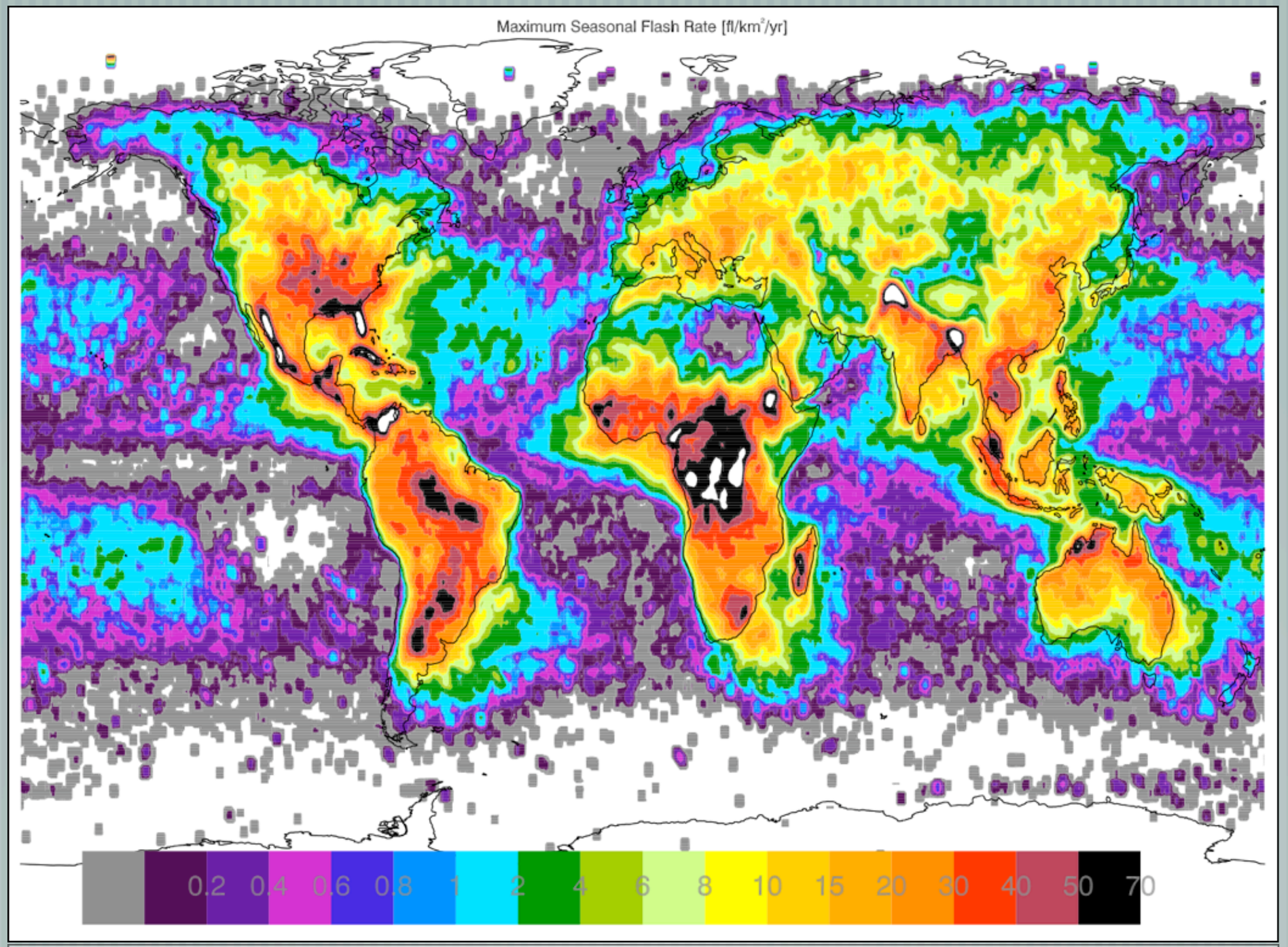
HRAC Peak Lightning Months



HRAC Seasonal Cycle Amplitude



HRAC Peak Seasonal Flash Rate



LRAC (Low Resolution Annual Climatology)

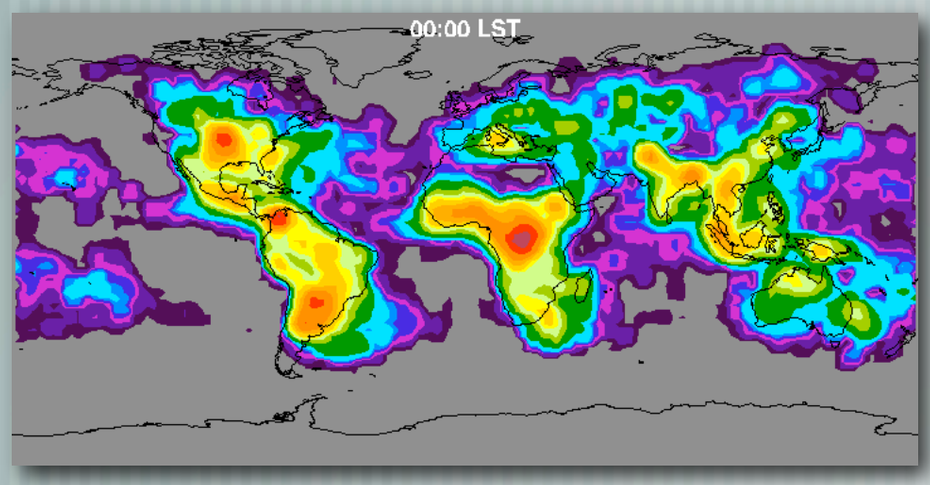
- SDS: LRAC_COM_FR (daily):
  - 2.5 deg resolution, 365x144x72; flashes / km^2 / day
  - Low resolution version of HRAC

LRADC (Low Resolution Annual / Diurnal Climatology)

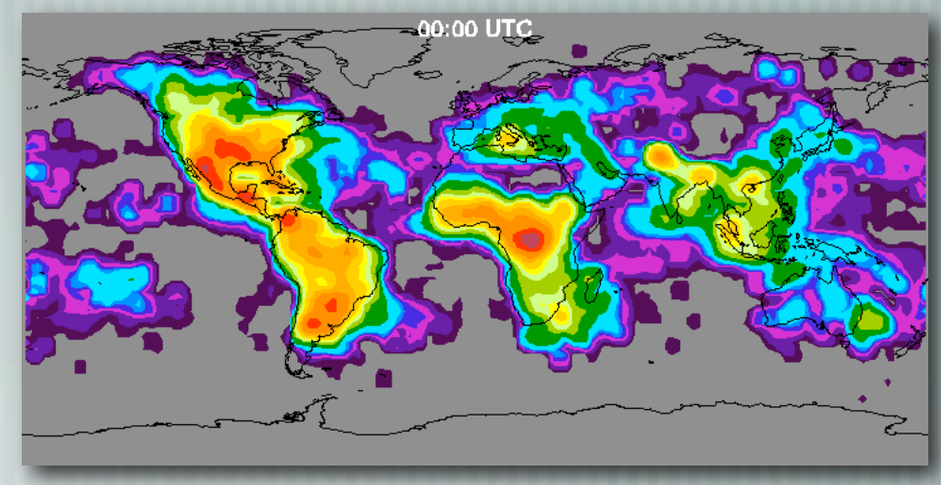
- SDS: LRADC_COM_SMFR:
  - 2.5 deg resolution, 365x6x144x72; flashes / km^2 / day
  - Smoothing as in HRAC, LRAC
  - 6x 4-hourly UTC bins (0-4, 4-8, ... 20-24)
- SDS: LRAD_COM_SMFR2:
  - 2.5 deg resolution, 365x12x144x72; flashes/ km^2 / day
  - 12x 2-hourly UTC bins (0-2, 2-4, ... 22-24)

LRDC (Low Resolution Diurnal Climatology)

- SDS: LRDC_COM_FR (daily):
  - 2.5 deg resolution, 24x144x72; flashes / km^2 / hour
  - 24 local hour bins (0-1, 1-2, ... 23-24 LST)



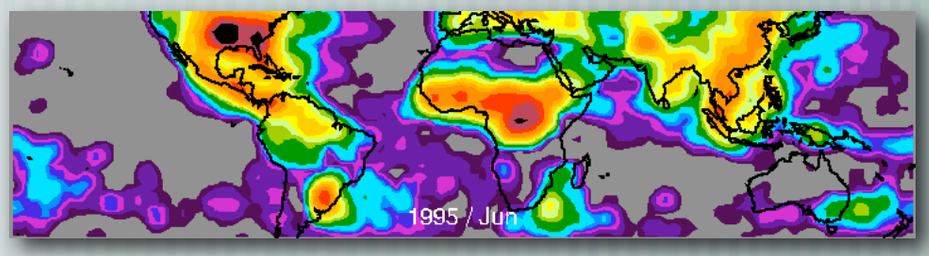
Local



Converted to UTC

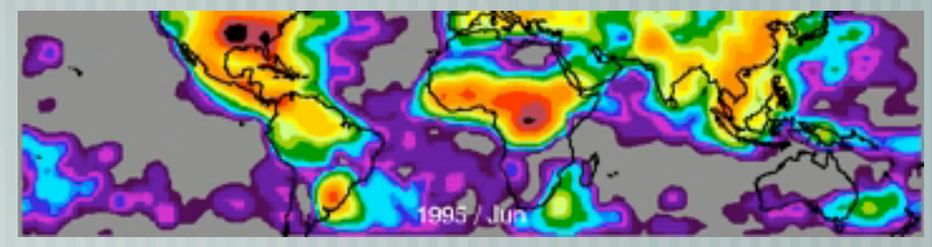
LRMTS (Low Resolution Monthly Time Series)

- SDS: LRMTS_COM_FR:
  - 2.5 deg resolution, 144x144x72; flashes / km^2 / day
  - 144 months beginning 1/1/05; first 5 and last 8 months empty
  - 7.5 deg spatial moving average
  - 110-day or 98-day temporal smoothing (OTD, LIS)
  - OTD and LIS grids weighted by respective viewtimes during overlap window (12/97 - 04/00)



LRTS (Low Resolution Time Series)

- SDS: LRTS_COM_FR:
  - 2.5 deg resolution, 3653x144x72; flashes / km^2 / day
  - 4261 days beginning 1/1/05; first and last few months empty
  - 7.5 deg spatial moving average
  - 110-day temporal smoothing



- SDS: LRTS_LIS_FR:
  - As above, but LIS-only; 98-day smoothing

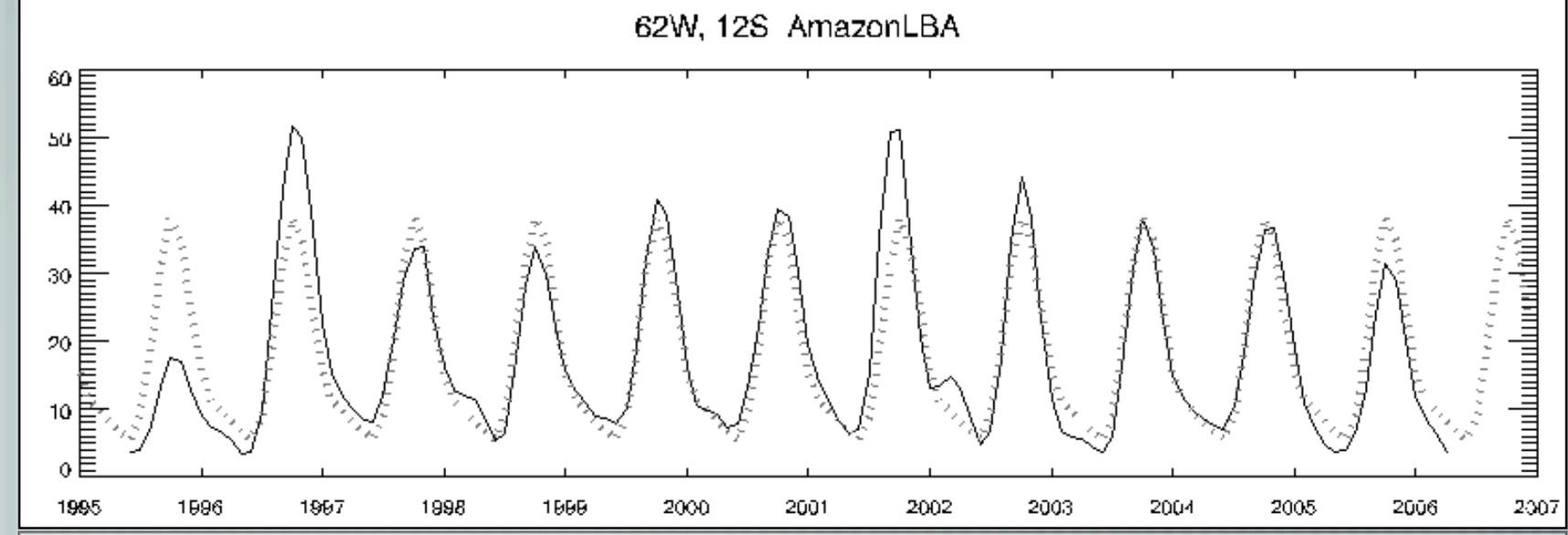
LRACTS (Low Res Annual Clim Time Series)

- This is a special version of the LRAC (2.5 degree annual climatology) created for use with the LRTS time series product
- It uses the same spatial / temporal smoothing as LRTS
- It can thus be used as a “baseline” against which time series anomalies in the LRTS can be compared.
- This is more accurate than comparing against the LRAC

LRTS / LRACTS Example

- Full time series for a (7.5x7.5 smoothed) location centered at 61W, 2S (near TRMM-LBA / Rondonia)
- LRTS is the solid curve; LRACTS (repeated annually) is the dashed curve

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Mean	15.3	11.2	9.7	8.1	6.8	5.8	9.1	19.0	31.5	38.0	34.7	24.4	18.6
1995						3.8	4.0	7.7	13.5	17.4	17.0	12.9	
1996	8.9	7.4	6.8	5.4	3.5	3.7	9.6	24.7	42.1	51.7	50.0	36.6	20.9
1997	22.4	15.2	11.6	10.0	8.5	8.0	11.9	20.4	29.0	33.7	33.9	23.3	19.0
1998	16.2	12.9	12.0	11.3	8.8	5.3	6.6	15.6	28.2	33.9	29.8	22.1	16.9
1999	15.6	12.6	10.8	9.0	8.7	8.0	9.9	18.8	31.9	40.9	38.5	27.1	19.3
2000	15.8	10.6	9.9	9.2	7.3	7.9	13.2	22.1	33.1	39.4	38.4	29.9	19.7
2001	19.5	14.0	11.1	8.2	6.5	7.0	15.4	35.2	50.8	51.1	36.7	20.6	23.0
2002	13.1	13.3	14.7	13.1	8.4	4.9	6.7	17.7	34.7	44.0	37.9	23.3	19.3
2003	11.4	6.7	6.0	5.8	4.7	3.6	5.9	16.1	30.6	38.0	33.6	23.0	15.4
2004	14.7	11.4	9.9	8.7	7.6	7.1	10.4	18.1	28.3	36.3	36.6	29.6	18.2
2005	19.0	11.0	7.1	4.7	3.7	4.1	6.3	12.8	24.0	31.3	29.0	20.2	14.4
2006	11.7	8.4	6.4	3.7									



getgrid.pro

- IDL Routine (v5 or higher)
- *getgrid*,**hdfname**,**sdsname**,gridvar,dims,dimnames,dim0,dim1,dim2
  - hdfname: HDF file name (full path if not local); e.g. “LISOTD_HRAC.hdf”
  - sdsname: SDS grid name, e.g. “HRAC_COM_FR”
  - gridvar: IDL variable in which the grid will be returned
  - dims, dimnames, ...: IDL variables in which the dimensions will be returned